Advanced Eye Monitoring Technologies: Ready for Operational Platforms

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Operational Scenario for Technology

AP

US makes Cuba embassy cuts permanent after 'health attacks'

By JOSH LEDERMAN and MATTHEW LEE
Mar. 02, 2018

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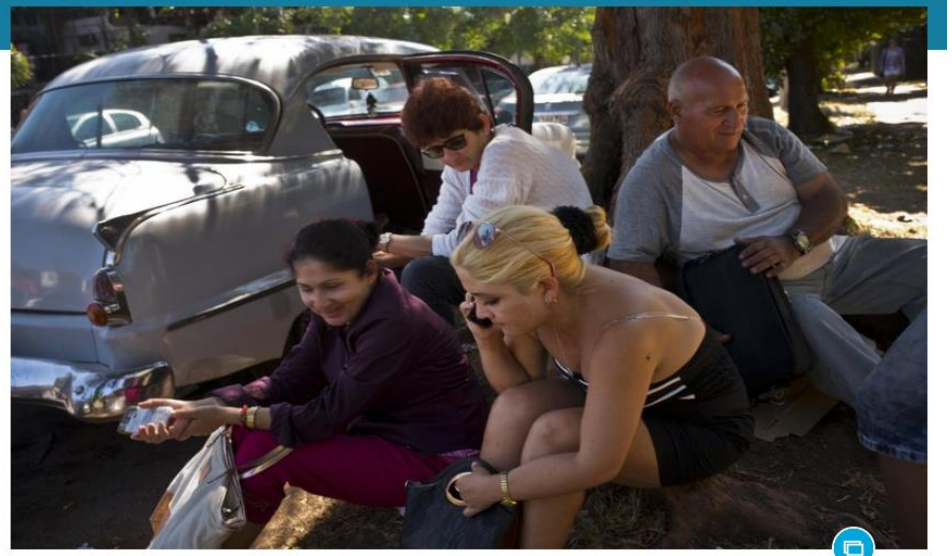

WASHINGTON (AP) — Citing mysterious "health attacks" in Havana, the United States said Friday it is making permanent its withdrawal of 60 percent of its diplomats from Cuba, extending an action that has hurt the island nation's economy and cramped Cubans' ability to visit the U.S.

Last October, the State Department ordered non-essential embassy personnel and the families of all staff to leave Havana,

US Embassy in Cuba to reduce staff indefinitely after 'health attacks'

By Laura Koran and Patrick Oppmann, CNN
Updated 6:38 PM ET, Fri March 2, 2018

The American flag flies at the U.S. Embassy following a ceremony August 14, 2015, in Havana.

Colleagues

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Assessing Effects in Havana

- **Late 2016 – 2017, reports of sudden onset dizziness, ear pain and tinnitus in diplomats and family members (no DoD personnel)**
- **Many reported hearing a loud, high frequency, very localized sound capable of following them in a room**
- **Some reported a pressure sensations localized in a room**

Assessing Effects in Havana

- **Over 140 individuals with suspected exposures were examined at University of Miami or in Havana, Cuba**
- **Identified 35 individuals with appropriate history, symptoms and perceived exposure**
  - **Perception of sound or pressure**
  - **In same room with a person with perception**

Assessing Effects in Havana

- **The 35 individuals examined at University of Miami, Miller School of Medicine, 7-60 days after most recent reported exposure**
- **21 males, 14 females; 42.3 ± 11.3 years, all <64 years old**
- **Comprehensive history, physical exam which include, standard eye movement testing**
- **Specialized clinical and neuropsychological testing based on history and physical exam**
  - **Subsets received specialized testing needed to confirm a diagnosis**

Assessing Effects in Havana

- **Exams of ten individuals with no symptoms were within normal limits (Unaffected Group)**
  - **One reported a ‘force wave’ sensation**
  - **One reported a single but very brief perception of high pitched sound**
  - **Eight were present in the same room as someone reporting an exposure**

Symptom Reports

SYMPTOM	Unaffected group	Affected Group
Dizziness (Yes:No)	0:10 (0%)	23:2 (92%)*
Cognitive (Yes:No)	0:10 (0%)	14:11 (56%)*
Hearing Loss (Yes:No)	0:10 (0%)	8:17 (32%)*
Tinnitus (Yes:No)	0:10 (0%)	8:17 (32%)*
Ear Pain (Yes:No)	0:10 (0%)	7:18 (28%)*
Headache (Yes:No)	2:8 (25%)	6:19 (24%)
MULTIPLE SYMPTOMS		
At least 2 Symptoms (including HA/excluding HA, Yes:No)	0:10/0:10	24: 1/24:1**
At least 3 Symptoms (including HA/excluding HA, Yes:No)	0:10/0:10	16:9 /14:11**

*Significant difference compared to asymptomatic group, Fisher exact test, $p<0.01$

**Both values are significantly different compared to the asymptomatic group, Fisher exact test, $p<0.01$

Clinical Findings

CLINICAL FINDING (Affected Patients)	Number Tested	Abnormal	Within Normal Limits
Subjective Visual Vertical (SVV)	25	23	2
Chair Rotation HVOR	11	9	2
Central Vestibular Findings		6	5
Antisaccade test (abnormal error rate)	23	12	11
Cervical Vestibular Evoked Myogenic Potential (cVEMP)	9	7	2
Ocular VEMP (oVEMP)	9	7	2

Cognitive and Neuropsychologic Findings

Case #	Premorbid estimate of intellect	Subjective complaints	Neuropsychological Findings
1	NART=114; High Average	• Forgetfulness • Mental fog/Slow performance • Difficulty with complex attention • Reduced motivation	• Diminished working memory • Slowed processing speed • Inefficient verbal learning • Reduced verbal fluency • Weak grip strength
2	NART=114; High Average	• Forgetfulness • Poor concentration/planning difficulty • Difficulty retrieving words • Mood swings • Increased irritability • Lack of motivation	• Mildly impaired verbal learning and memory • Mild attentional problems • Reduced word finding • Mild depression
3	NART=117; High Average	• Slower processing • Difficulty multi-tasking • Difficulty retrieving words • Greater level of effort required to complete simple tasks	• Reduced speed of processing Weak grip strength • Diminished sustained attention/ problems sustaining mental set • Difficulty making rapid visual comparisons

Abbreviation: NART- National Adult Reading Test

Cognitive and Neuropsychologic Findings

Case #	Premorbid estimate of intellect	Subjective complaints	Neuropsychological Findings
4	Average	• Slower processing • Attentional problems	• Slow processing speed
5	NART=117; High Average	• Slower processing • Difficulty concentrating • Difficulty multitasking • Feeling confused • Irritability	• Reduced ability to focus in the face of competing stimuli • Episodic memory • Attention • Working memory difficulties • Weak grip strength.
6	NART=106; Average	• Forgetfulness • Slower processing • Poor concentration • Word finding difficulties • Indecisiveness • Irritability, increased tearfulness • decreased interest in activities, anxiety & mood swings	• Difficulty with verbal memory • Reduced fine motor speed • Reduced ability to focus in the face of competing stimuli • Poor Grip Strength • Moderate depression • Mild Anxiety and apathy

Cognitive and Neuropsychologic Findings

Case #	Premorbid estimate of intellect	Subjective complaints	Neuropsychological Findings
7	NART=115; High Average	• Forgetfulness • Slower processing • Difficulty retrieving words • Mood lability & anxiety	• Decreased visual memory • Reduced verbal fluency • Weak Grip Strength
8	NART=88; Low Average	• Forgetfulness • Slower processing • Poor concentration • Difficulties with organization • Difficulty monitoring • Word finding difficulties	• Difficulty with simple verbal and visual attention, visual processing • Reduced ability to focus in the face of competing stimuli • Reduced vocabulary • Mild depression
9	Average	• Poor concentration	• Slow processing speed • Diminished abstract problem solving

Summary

- **Extremely high incidence of objective signs (e.g., abnormal SVV, rotational testing and VEMPs) of underlying asymmetric vestibulopathies and otolithic abnormalities.**
- **Presentation more homogenous than most mTBI populations.**
- **Lower prevalence of headache than typical for mTBI.**

Summary

- **Cognitive symptoms (e.g., problems maintaining sustained attention, slower processing speed, difficulty multi-tasking, and word retrieval difficulties) similar to mTBI or decompression sickness but more pervasive and consistently paired with emotional symptoms that included irritability, anxiety and depression.**
- **Elevated prevalence of abnormal anti-saccade task error rates.**

Source of Exposure Unknown

- **Potential directed energy sources include**
  - **Hypersonic sound**
  - **Pulsed radiofrequency**
  - **Pulsed laser source**
  - **Ultrasound (e.g., from photoacoustic device)**
- **Receiver characteristics: Waveguide, resonance and cavitation properties of intracranial contents**

Caution re: Symptom Reports

- Causal attributions for symptoms associated with balance disorders and mTBI, including neuropsychological complaints, are unreliable.
  - Attribution obvious for overt exposure scenarios (blast wave exposure or blunt impact to the head)
  - Problematic for dizziness due to a covert cause. For example, ear pain and cognitive symptoms are aversive so may produce conditioned aversion with misattribution.
    - Analogy to conditioned taste aversion: nausea and the symptoms may be attributed to irrelevant but novel conditions that merely coincide temporally with the proximate cause.